Project Summary

US Army Engineer
Research and Development Center
Waterways Experiment Station

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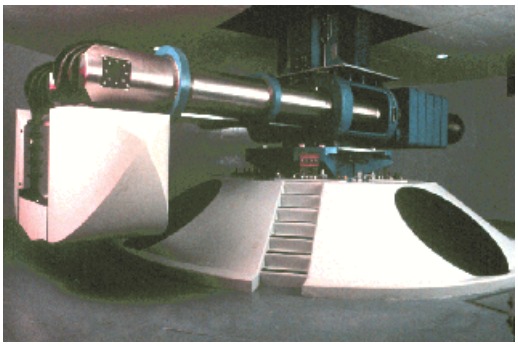
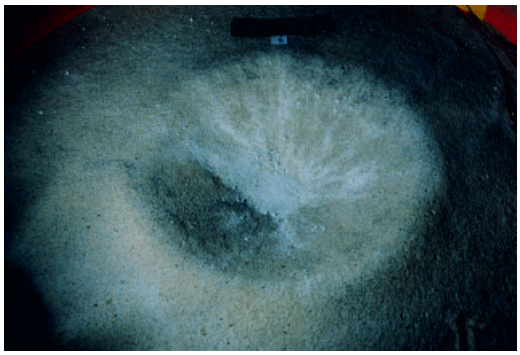
Precision Scale Explosive Tests in the Centrifuge





Introduction: Precision scale explosive testing, in combination with numerical simulations and supporting laboratory constitutive properties testing, can provide a mechanism for rapidly and efficiently advancing the state-of-art in blast effects research. Large-scale tests are expensive in terms of both time and resources. Because of their costs, many interesting large-scale tests are never performed, or are performed without duplications of event or redundancy in the measurements. Partnering with the Structures Laboratory, a test plan was developed for precision scale explosive tests to be conducted on the US Army centrifuge. This device allows experiments to be conducted with correctly scaled gravitational fields so that late time effects, such as cratering motions or long-duration structural response, are faithfully replicated using precision small-scaled experiments. The extremely large payloads of the Army centrifuge allows scaled test beds to be used which place reflecting boundaries at appropriate distance from the charges.

Scope of Work: The first series of explosives tests performed on the Army Centrifuge will be used to established precision scale test methods and identify critical problem areas. Critical problem areas identified included developing and validating precision, reliable scale charges and reliably and precisely detonating these charges on the centrifuge; accurate placement of instruments; and performing high-frequency data recording and signal conditioning of ground motion instruments during flight. The ultimate objective is to be able to replicate at small-scale the complete explosive test capabilities.

Status of Project: Completed. Three centrifuge tests were conducted with live charges. The experiments showed good repeatability, and they replicated the prototype crater with good accuracy. While large-scale experiments will continue to be needed in the future, the number of experiments will likely decrease. The results from these precision-scale experiments demonstrate the internal consistency of the models and confirm the potential of greatly reducing the time and money necessary to predict the outcome of a wide variety of weapons detonation scenarios.

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